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LARGE-SCALE EFFORT FOR METHANOL FROM PEAT

Stockholm NY TEKNIK in Swedish 20 May 80 p 5

[Article by Miki Agerberg: "Large-Scale Effort to Extract Methanol From Peat"]

[Text] Now Swedish techniques for extracting methanol gas from peat and bio-mass matter will be tried on a large scale. The council for energy production research, NE, has asked government permission to invest 21.5 million kronor to build an experimental plant in Studsvik. The primary goal is production of methanol from domestic fuel.

"Sweden has good competence as far as gasification of bio-fuels is concerned," says Per Johan Svenningsson, program leader for synthetic fuels at NE.

"That competence has been developed through research at technical universities in Stockholm and in Lund during the seventies. Now the time has come to try a Swedish process on a larger scale."

As far as Swedish methanol production by means of gasification is concerned, the work at present proceeds along two lines. One is to build a demonstration plant with available foreign techniques.

Here the so-called Winkler process, a tried and tested technique for gasification of brown coal, will be used; the process will be adopted for peat and bio-mass. This is the demonstration plant which different communities are fighting to get right now.

The other line is the experimental plant NE wants to build in Studsvik. There a process developed in Sweden will be employed. This process is made to measure for peat and bio-mass.

The process utilizes the fact that peat and bio-mass have high reactivity compared to for example coal.

In a fluidized bed the raw material is first converted into raw gas in a fast process. The gas is then purified at high temperature with filters.

The particle-free gas, which is now at cia 500 degrees Celsius, continues one catalytic step further; among other things tar is here converted into carbon monoxide and hydrogen gas.

Self-Supporting Plant

Heat is extracted from the gas, and the gas may then be used as raw material of methanol synthesis.

"The effect turns out to be higher than with the Winkler process, about 55 percent." So says Erik Rensfelt, who is project leader at Studvik.

"The plant will be self-supporting: among other things, it will produce its own electricity. And there is no problem with tar."

Now NE and Studvik are waiting for the government to give a green light for the plant. It will take 2 years to build, and then the plan is to run it for a trial period of three years. At the universities in Stockholm and in Lund, research to support the project will continue.

The total cost of the whole project is estimated at about 500 million kronor.

By and by the time will come to decide what the first full-scale Swedish methanol plant will look like--a plant that will be able to produce 0.5-1 million tons of methanol annually from Swedish peat and bio-mass.

At that time it is hoped there will be experiences to build on, both from the experimental plant in Studsvik and from the larger demonstration plant with adapted foreign techniques.

9542
CSO: 3102

GEOTHERMAL ENERGY: STATUS, PROSPECTS DISCUSSED

Rome NOTIZIARIO in Italian Apr 80 pp 73, 75

[Article by Maria Luisa Perilli: "Geothermal Energy: Its Current Status and Prospects for Development"]

[Text] The recent--and second--energy crisis of the decade just concluded (the first was the notorious petroleum crisis of 1973) has lent new impetus to the research and programs being carried out in many countries in regard to the possible utilization, on an industrial scale, of alternative sources of energy.

As has been confirmed many times recently, however, at meetings and conferences including the St Vincent International Energy Conferences of November 1979, alternative energy sources can make only a modest contribution (4 to 5 percent, no earlier than the year 2000) toward satisfaction of the total energy requirements.

There are many reasons for this, among which the most important are the insufficiently developed technology, nonhomogeneous geographical distribution of resources, and environmental impact. In connection with the latter point it is well always to remember that there is no such thing as a "clean" energy source--one that poses no risks for the population. Given the current status of research with respect to the various alternative energy sources under consideration, geothermal energy may have good prospects for development--especially in our country, where favorable geologic conditions have made its utilization possible ever since the turn of the century.

Geothermal energy is energy that can be extracted from underground water circulating either naturally or artificially in areas where the geothermal gradient (the increase in temperature in proportion to the depth within the earth) is anomalous--ie, higher than normal. (The geothermal gradient varies from one site to another but averages 30 degrees centigrade per 1,000 meters.)

As has already been pointed out, Italy offers geologic conditions that are especially favorable for the discovery of geothermal fields. These

resources, however, are concentrated in a narrow belt between the Tyrrhenian Sea and the Appenine chain extending from Tuscany, Latium and Campania to Sicily.

With respect to the production of electric power--which requires high temperatures (for the most part, fluids are used today at temperatures of 150 degrees centigrade or above)--90 percent of these domestic resources are concentrated in the pre-Appenine Tuscany-Latium-Campania belt. Almost half of the resources within this belt are concentrated in south central Tuscany alone.

Until 1958 Italy was the only nation to exploit geothermal energy.

It is well known that geothermal energy was utilized for the first time to produce electric power in the Larderello area of Tuscany at the turn of the century.

At the present time the Italian installations account for 33 percent of the entire installed capacity of the world (see Table I).

Table I. Utilization of Geothermal Energy in the World

Country	Electric power capacity (MWe) [megawatts of electric power] Installed (1979)	Estimated (1985)	Nonelectric uses (MWt) [thermal megawatts] (1979)
USA	522	6,000	15
Italy	421	800	21
New Zealand	202	400	340
Mexico	78.5	400-1,400	--
Japan	170	2,000	15
Philippines	160	300	--
San Salvador [sic]	85	180	--
Nicaragua	--	150-200	--
Iceland	12.5	150	439
Costa Rica	--	100	--
Guatemala	--	100	--
Honduras	--	100	--
Panama	--	60	--
Taiwan	--	50	--
Portugal (Azores)	3	30	--
Kenya	--	30	--
Guadeloupe	--	30	--
Spain	--	25	--
USSR	5.7	20	115.001
Turkey	0.5	10	100
Canada	--	10	--
Hungary	--	--	1,133
France	--	--	40
Chile	(20)	--	--
China	(6)	--	--

In 1978 the useful geothermal resources (ie, that part of the accessible resources which is estimated to be extractable within the not too distant future) were valued at 50,000 GW [gigawatts] and the reserves (ie, those resources which can be utilized by means of the technology in existence at the time the estimate was made) at 12,000 GW. Of the reserves, 1,900 GW is located in south central Tuscany, which--with an installed capacity of 420 MW [megawatts] and a production of electric energy of approximately $2.5 \cdot 10^{9}$ kWh [kilowatt-hours], equal to 1.7 percent of the nation's total electric power production (see Table II)--is the only area in Italy currently being exploited.

Table II. Energy Balance Sheet of the ENEL

Production of the Plants	1978 Billions of kWh	1978 %	1979 Billions of kWh	1979 %	Variations from 1978 to 1979
Hydroelectric	34.9	26.1	35.0	24.7	−1.4
Thermal electric (traditional)	94.1	70.3	100.3	70.7	+0.4
Geothermal electric	2.5	1.9	2.5	1.7	−0.2
Nuclear thermal electric	4.4	3.3	2.6	1.8	−1.5
Total	135.9	100.0[1]	140.4	100.0[1]	−2.7

In other countries the progressive development of geothermal energy dates back less than 20 years. In 1979 world geothermal production was limited to ten countries, including Italy, for a total installed capacity of approximately 1,600 MWe.

Various countries are now coming forward with studies that are already in an advanced stage, and others are laying the foundations for a preliminary stage of research.

In the past decade the progress of research and the improved technologies at the international level have led to consideration of the possibility of exploiting ground heat in a variety of forms.

In discussing the exploitation of geothermal sources, therefore, one must make a distinction between the exploitation of "natural" geothermal systems (existing systems that are viable in the short term) and the exploitation of "artificial" geothermal systems (hot dry rocks: a long-term objective, at least as regards the Italian programs).

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1. The value of 100 percent is obtained by including the balance with foreign countries (3.8 percent in 1979 and 1.6 percent in 1978); the third-party balance (3.8 percent in 1979 and 3.3 percent in 1978); the energy absorbed by auxiliary services (—4.4 percent in 1979 and —4.5 percent in 1978); and the energy absorbed by pumping (—2.1 percent in 1979 and —2.0 percent in 1978).

At the present time, geothermal energy is being exploited solely by extracting heat from the rocks by means of the natural fluids (water or steam) that circulate in the rocks themselves. This type of utilization of geothermal energy naturally involves a series of technological and environmental problems such as disposal of the residual water (which is still hot and frequently contains pollutants), soil subsidence and so forth.

As has already been pointed out in connection with the production of electric power, fluids at a temperature of approximately 150 degrees centigrade are being used at the present time. Hot water at lower temperatures--which is available in many countries--can be utilized either for nonelectric uses (with a substantial saving in fossil fuels) or for the production of electric power (but at a higher cost).

The exploitation of "artificial" geothermal systems (the hot dry rock project, now in the research stage) could be--when the financial, technological and environmental problems are solved--one of the most promising forms of utilization of geothermal energy.

The technique consists of exploiting the natural heat of deep dry rocks (ie, rocks whose permeability is low or nil), by causing cold water injected from the surface to circulate among them.

The rock should be fractured previously, in order to promote circulation of the water.

The cold water--which is heated upon contact with the rock--is recovered on the surface in the form of superheated steam and dispatched to the turbines for the production of electric energy.

Prominent among the studies carried out on the subject are those of the United States Department of Energy (DOE), which since 1974 has had under study a project near the Los Alamos Laboratory to set up a small power plant in New Mexico.

A large-scale program of research and development of geothermal energy is also being carried out by the EEC. The Community has provided financing for this energy source in the amount of 13 MUCE[2] (millions of European units of account) for the 1975-1979 program, and 18 MUCE for the 1979-1983 program.

In Italy, all activities in respect to the research and development of geothermal energy are currently being conducted by the ENEL [National Electric Power Agency] (which has the geothermal fields at Lardarello, Tuscany, in production); AGIP [National Italian Oil Company] (in a joint venture with ENEL, is about to bring into production the geothermal fields

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2. One European unit of account (UCE) equals 1,100 lire.

at Campi Flegrei, Naples); CNR [National Research Council] (with the Geothermal Energy Subproject, as part of the Finalized Energy Project); and CNEN [National Nuclear Energy Commission].

We are publishing herewith a study by the Environmental Geochemistry Laboratory of La Casaccia concerning the research which the CNEN is conducting in the sector of geothermal energy.

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10992
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NORWAY INVESTS 41 MILLION KRONER IN ENERGY RESEARCH

Stockholm NY TEKNIK in Swedish 22 May 80 p 10

[Article: "Norway Invests 41 Million in Energy Project"]

[Text] Norway: 120 energy research projects have received state support in Norway. So far this year 41 million Norwegian kroner have been distributed, on top of the state budget. The greatest amount goes to research for wave powerplants. 15 million of the 28 million total invested in research for alternate energy sources.

Wind energy research, on the other hand, will receive only 2.2 million, and about the same amount goes to solar energy research. Projects aimed at better energy conservation have received 13.5 million for 1980.

9542
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APPLICATIONS OF MINICOMPUTERS, MICROCOMPUTERS DESCRIBED

Estavayer-le-Lac L'INDICATEUR INDUSTRIEL in French May 80 pp 3, 5-6, 25-28

[Article by D. M.: "Mini- and Microcomputers Explained for the Benefit of Mechanical Engineers"; from INGENIEURS ET TECHNICIENS]

[Text] Industrial Applications of Minicomputers

Companies of all kinds, which never dr amed of using a computer several years ago, today use a minicomputer everyday for economic reasons. As a matter of fact, the growing cost of manpower and the decreasing cost of "minicomputers" sooner or later make the latter more economical than manual methods in almost all applications. Besides, the minicomputer presents numerous advantages over manual or conventional methods, such as reliability, economy, gain in terms of size and weight, and especially increase in productivity.

The applications are very numerous and their number keeps going up as prices keep going down. According to a survey by Data Pro, the most frequent applications can be broken down as follows:

Telecommunications message control	22.5%
Share time	2.7%
Total tele-information system	25.2%
Management	9 %
Teaching programming Computer-assisted teaching	7.2%
Miscellaneous	7.3%
Total management and miscellaneous	23.5%
Industrial automation	22.5%
Research offices	18 %
Research laboratory	10.8%
Total industrial and technological applications	51.3%

Industrial and technical applications thus account for more than half of all of the applications. As for those under the heading of management,

they are only beginning to show up, hence their rather meager 9 percent which will certainly go up. Before taking up the industrial applications which are of particular interest to us here in this article, let us take a quick glance at telecommunications.

In this field, minicomputers have become indispensable for remote surveillance of exchanges and in maintenance equipment. The CNET [National Center for Telecommunications Studies] uses more than about 30 of them for its research work, especially in the telephone exchanges, to express the call sign requested for routing communications, for observation of component member occupation as posted on the histograms, for the performance of "computer service by telephone--SCT," and for the observation of the characteristics of the atmosphere by means of acoustic radar. The data transmission system of the Paris subway, RER, is another example of utilization for centralization and control of transmissions between different points in the network. The big central computers can then be concentrated entirely on data processing. This results in an obvious saving. We finally note that in tele-information science, minicomputers are most frequently used as concentrators of data or at terminal stations which some people stubbornly insist on calling "smart"--which is hardly smart on their part --because they handle certain local processing operations. How can a machine be smart?

Industrial applications can be classified in four groups: process surveillance, process automation, automatic testing of semifinished or finished products, and technical calculations. As a matter of fact, this classification is arbitrary because it suffices to close the loop on a surveillance device to automate the process. On the other hand, automatic testing of semifinished products is often used to automate the processes such as we will see with the help of several examples.

Industrial Process Surveillance

In these applications, minicomputers play the role of data concentrators. But in addition they instantaneously perform complex arithmetic calculations and logic operations, before presenting the results to the surveillance operator whose work they "chew." This is particularly useful when the process is complicated and would require surveillance personnel with great experience in order to cope with the numerous information items coming at them and make the proper decisions. On the other hand, when the already processed results are presented to the surveillance operator, the latter needs only very little experience to make his decision. At the extreme end, one can close the loop and leave it up to the minicomputer to make the decision and act upon the process, as we saw in earlier articles. Among the co[illegible] surveillance installations, we might mention the following which were published in a list by La Telemecanique: control of liquefied gas production, surveillance of electric power plant, of petrochemical installations, surveillance of electrical power distribution, of longitudinal cutting for rolling mill, of a textile production assembly line, etc.

Their utilization is considerably developed in certain industries, such as the steel industry (Figure 1). There are even minicomputer networks under the direction of a "mini" center [exchange] which receives data on the activities of those [computers] which it supervises. Thus, when the workshop is stopped, the central computer is informed of that and can distribute the tasks of this workshop as a function of the manufacturing programs registered in its memory.

Process Automation

In replacing the surveillance operator by an equipment device controlled by computer, we actually put together a closed loop. This device consists of the peripheral output units which play the same role as the surveillance operator, although much faster than he and without emotion or fatigue.

Among the main reasons for the success of the "minis" and "micros," we find first of all the noteworthy reduction in production costs, the decline in development expenditures and the duration of research and development. Thus, the finished products can be sold faster and this makes it possible to grab a larger slice of the market. The features of the products sold are better and the designer can sometimes add others, at little cost, which would facilitate sales. Since the product is of better quality, the warranty and service expenditures after sale are considerably reduced. One can even put out entirely new products.

"Minis" and "micros" are beginning to make their appearance in numerous industrial automated control devices. We find them, for example, in numerical controls for machine-tools which we will study separately, in conveyor belts, and in robots which handle separate parts, the insertion of robots (Figure 2), control of pumping stations, manufacturing of radio parts, tires, synthetic textiles, and regulation of paper machines, featuring control of the weight per square meter, optimization of machine flow rate, electrical welding, operating rolling mill trains, control of thermo-refrigeration plant at the Orly Airport by La Telemecanique, and even the printing of magazines by photocomposition (Figure 3). Certain automatic operations must be performed faster than the logic unit which is supposed to control them. To get around this difficulty, we use microprogrammed circuits designed to perform these operations--which, by the way, are repetitive--very rapidly. These microprogrammed circuits are controlled by the logic unit which guarantees great flexibility of employment and savings in programming.

Depending upon the complexity and speed of the automated process, we use a "mini" or a "micro." The latter, for example, controls a drawing-folding press, made by Varitol, Inc., Beverly Hills, California. So far, this type of monumental press could not be controlled by a series-produced device because of the fact that it was made in too many variants, with each requiring a control device with tailor-made wiring; that is no longer true in case of the microprocessor whose program is registered in easily removable dead memories.

It is being said in industrial circles that the channels [bus] are affected by numerous industrial parasites which are phenomena of high frequency. A simple way to render them harmless is to use slow microprocessors, such as Intel 8008, instead of the 8080 model, which is faster, and to add condensers on the channels [bus]. In this wa, e reduce the sensitivity to parasites about ten times without damage to he characteristics of the entire system assembly because the latter most ften, as the final element, includes an electromechanical device which, at any rate, does not come up with a very fast response. This bit of wisdom was pointed out by Paul M. Fintner, of Cutler-Hammer, Inc., Milwaukee, Wisconsin.

Likewise, a minicomputer of the Mitra 15 type was installed at the Gaillon Plant of the Armosig Company, the first-ranking French producer of plastic tubes [pipes]. Among its various functions, it accomplishes an extremely well-dosed mixture of raw materials.

The electronics industries obviously are not among the last to resort to information science because they have no complex in this regard. Thus, Motorola, one of the biggest producers of semiconductors in the United States, installed a minicomputer in one of its integrated-circuit manufacturing production lines, at Phoenix, Arizona. As of now, 60 percent of its output are getting the benefit of this progress, in other words, about 7,000 "bugs" per day. The purpose of this device is automatically to measure, during the course of manufacturing, the thickness and the resistence of the epitaxial layer of the semiconductor placed upon the "bugs." As a matter of fact, the quality of this layer is essential to guarantee the quality of the finished product and its control, immediately after deposit [coating] is imperative. So far, this control had been performed manually and we had the paradox where more personnel was needed to perform controls than to deposit the epitaxial layer. The automation of these controls eliminated this production bottleneck. It followed from this that the measurements are much more precise and that the cost price of integrated circuits has declined. Besides, this device automatically controls the thickness of the epitaxial layer with the help of a reaction loop. This installation can work with "bugs" of different dimensions, for epitaxial layers of different types and for different deposit processes. Without going into any details, which by the way were published elsewhere, we might point out that the measurement of the epitaxial layer's thickness is performed without physical contact, by means of IR interferometry. On the other hand, the resistance measurement requires the contact of points with the surface of the integrated circuits.

In France we also use minicomputers in manufacturing integrated circuits. We know that the conventional methods enable us to get photographic plates serving as masks whose trace has a degree of fineness amounting to as much as 0.6 μ. This record was beaten very considerably by SOGEME, of the Thomson-Brandt group, which made an electronic mask attaining a fineness of 0.1 μ. This apparatus in particular involved one minicomputer and two interferometers. The importance of this technique resides in the fact that, combined with the ionic implantation technique, it enables us to achieve a density on the order of 25,000 transistors per square kilometer.

Case of Machine-Tools

The numerical control of machine-tools was devised some years ago with the help of magnetic or punched tapes which controlled electromagnetic relays. Their wired logic unit can be replaced by a minicomputer in a first stage. Then, the signals necessary for processing a mechanical piece can be delivered directly by the computer, under the control of its program. The latter thus takes the place of the wired logic unit, made up of the numerous relays found in the conventional control set up. In practice, a single computer can control all numerical applications in a workshop, for example, those of the transfer assembly line. This possibility should not astonish us because we saw that a computer can process data coming from hundreds of detectors and can also control hundreds of industrial devices. The controls thus designed are much less cumbersome [expensive] than those of the conventional type which required a different numerical control for each machine-tool. When we want to modify the control mode, it suffices to modify or replace the logic unit, which we can do at any moment and which is much less long than having to wire a new device to the relay. Besides, this arrangement can grow together with the workshop because most of the current computers are modular both for the equipment and for the logic units. The standardization resulting from the use of computers to control machines is advantageous both for the machine-tool designer and for the machine-tool user. The former can, with the same computer, control all types of machines, from the simplest to the most complex, with a change of tools and transfer of piece-carrier pallets. The latter can demand special features which one can obtain rapidly by modifying the logic unit. Last-minute modifications at the foot of the machine, according to the changing requirements of the machining function, are also possible. The time intervals involved are reduced in a spectacular fashion. As far as the designer is concerned, this makes it possible to eliminate the stockpile of separate parts which would otherwise be necessary to put the different variants together since one can get them by simply modifying the logic unit. These modifications also enable us to introduce new techniques into a system already installed for quite some time and this also increases its lifetime and protects it against technological aging (Figures 4-7).

Another advantage deriving from the control of all machine-tools by a single computer is that it is no longer necessary to learn the employment mode of the numerical control of each machine which one calls "post-processor," but only the one for the single "mini." It is the only piece of equipment to be maintained, hence the simplification and improvement of work to be done by maintenance personnel. The disappearance of certain control relays--or perhaps even all of them when we interpose a programmable sequencer [sequence-control unit]--is a source of equipment and maintenance savings. Reliability is considerably increased. Maintenance personnel no longer need to be highly specialized because there are diagnosis programs which enable us quickly to determine the defective printed-circuit card. It suffices then to replace it, which is done instantaneously and reduces the duration of breakdowns. No conventional

wired numerical control system can have a diagnostic device as fast as this one. As a matter of fact, trouble-shooting in these systems with multiple relays is such a delicate affair that it was necessary to write an entire new book in order to present an efficient and practical method to be used in searching for breakdowns!

The use of a minicomputer also leads to numerous other advantages, such as the automatic compensation of the tool's length, as well as the compensation of the known inexactitudes of the machine's response loop. All of these information items are registered in the memory in order to perform the corrections during the operation of the machine. Likewise, the so-called "adaptative" control places the operation of the machine under the surveillance of the computer which regulates the advance speed in such a manner as to optimize the metal cutting. One can use a microprocessor for the interpolation and control of a servomechanism for a single axis; five microprocessors thus can control five axes. In establishing a hierarchy between them, one can put together any system whose logic unit is now made lighter. One can thus see appearing a new tendency which is rather far removed from the one we observe today, which uses micro-information science.

Among the other advantages, we note the possibility of registering a tool nomenclature with a view to planning their sharpening. Likewise, the registration of machine operating hours can be used to prepare a preventive maintenance program. On the other hand, the computer enables us to improve the organization of a workshop and to optimize the stocks, which is very appreciable during times of tight credit restrictions. But this brings us into the area of management applications which we said we were not going to go into.

Automatic Tests and Measurements

We will now come back to automatic measurements made by detectors in process automation. A new "generation" of measurement instruments, which some people of course will not fail to refer to as being "smart," is in the process of seeing the light of day. These instruments comprise microprocessors which relieve the user of the need for all routine handling operations. The elimination of wiring and control buttons with their mechanisms most often leads to a savings so that these measurement instruments are generally less expensive than those they replace (Figures 8 and 9).

Among the builders who are already making these types of apparatuses we might mention Test Line, Inc., Titusville, Florida; Boonton Electrics Corp., Parsippany, N.J., which has an automatic capacitance bridge; the qualifier 901 IC multimeter of Fairchild Systems Technology, Palo Alto, California; the Digitrend 220 recording unit of Doric Scientific Corp., San Diego, California; the Tektronix, Inc., adapter, intended to link its numerical oscilloscope to its type "31" programmable computer.

In the frequency meters and counters of the 9000 series of Dana Laboratories, Inc., an Intel 4004 microprocessor performs numerous functions. It measures the period of a signal, it calculates its average, it measures time intervals with a precision of a single pulse of 10 ns and it calculates the average and the ratio. It measures the pulse rise [surge] time because it automatically calculates the voltages corresponding to 10 percent and 90 percent of the maximum. It directly posts the rise [surge] time and calculates the duration of pulses or their widths.

In France we are also making automatic measurement apparatuses. One example among many is represented by Unitel which developed an automatic processing system for measurements made by a magnetic-resonance spectrometer, for the CEA [French Atomic Energy Commission] at Vaujours. Run by a 16-k-word Mitra 15-30, the entire assembly makes it possible to perform the following:

An accumulation of "n" spectra of the same sample;

The smoothing of information items received;

Calculations of the absorption rate, the position of the center, and the width of the ray, and of the percentage of the deviation from the Gaussian.

The utilization dialogue is prepared with the help of a cathode console which, with the help of a special graphic device, makes it possible to post the spectra received in order to check the adjustment of the spectrometer. Curves which are judged satisfactory on the console are traced on a Hewlett-Packard analog table, connected to the Mitra 15. The results of processing a sample are recorded on numerical minicassettes to permit further processing or comparison with another experiment.

We know the time necessary to control the output of a workshop. When it goes into the thousands of pieces per hour, such as in the semiconductor industry, where the controls are numerous and complex for each piece, we can see that only an automatic device can handle such a task. The latter is generally equipped with a "mini" or "micro," as the case may be. They send stimuli toward the component to be tested, they analyze its reactions, and they mark it as "good" or "outside tolerance." This principle is used in numerous manufacturing processes. In the aviation industry, it is necessary to subject prototypes to numerous tests on the ground before they can be made to take off in order to limit the risks. These tests must take into account a large number of factors so that manual tests take a long time to perform and to interpret. The introduction of computers into the test benches has made it possible considerably to reduce those time intervals: tests corresponding to three flying hours are now performed in less than 10 minutes. Thus, Boeing, the American aircraft builder, incorporated a PDP 8 minicomputer in its test benches. Just one "mini" is enough because the tests are performed on subassemblies, rather than on the entire aircraft. The tests deal with numerous points, such as the structure, the power plant, the controls,

and the electrical systems. The computer's modular design makes it possible to adapt it to the various prototypes to be tested over a number of years. In a modular minicomputer, one can disconnect different parts, such as the memory sections, the input and output controllers, without affecting its operation, apart from the disconnected modules.

The simulation of an environment, such as the ocean, is another application here. An example in this case is the Naval Underwater Systems Center, New London, Connecticut, in the United States. When it developed a sound detection apparatus, making it possible to spot submarines, called Sonar, it had to perform tests at sea which is expensive and awkward. For example, certain tests required particular environmental conditions or the presence of several vessels or two of them at a time. All of these inconveniences were eliminated through the use of a computer which simulates the ocean and takes care of the laboratory test development. This solution is particularly advantageous in the case pointed out because one can use mathematical models of the ocean which one currently uses to train sonar operators. These models have proved themselves and entail very little in the way of inexactitudes. A Supernova minicomputer, by Data General, controls the system, while a Honeywell DDP 516 computer contains a model of the ocean and plays the role of peripheral environment.

Automatic Terminal Stations

To reduce the number of data transmitted on lines linking computers to terminal stations, the latter are equipped with "minis" or "micros," which enables them to perform various prior routine operations which the computer thus does not have to bother with. These operations depend on the type of terminal. It is often mistakenly referred to as being "smart" (Figure 5).

There is a large number of automatic terminals. For example, Texas Instruments has just put out a programmed terminal, the 742 PDT model, equipped with a silent printer with semiconductor mosaic, called Silent 700. This terminal in particular involves an internal microprocessor associated with a memory of 10 k octets. It can execute more than 75 instructions and has two cassette stations.

Imlac Corp., represented by Gepsi, has come out with a minicomputer equipped with PDS 4 cathode consoles, which gives it the characteristics we normally get with much more expensive systems.

The GT 42 graphic terminal of Digital Equipment comprises a PDP 11/10 and a photosensitive crayon making it possible graphically to talk to the "mini."

Along this line of ideas, there are microprocessors which handle the decoding and execution of instructions in disk memories of the IMSAI 108 type made by IMS Associates.

Engineering Calculations

Minicomputers began their career in development bureaus and research laboratories. Their small dimensions and low price, as well as the easy way they can be operated, were attractive to many engineers and technicians. Like all computers, they make it possible instantaneously and automatically to perform operations in series, in accordance with the program registered in the memory, without any human intervention during the operations. Computers are particularly suitable for repetitive calculations which we encounter frequently when we must vary the parameters until we get the desired results, in connection with the calculation of a project, for example. On the other hand, when we must perform these same calculations with an electronic desk calculator, we must put the data in with the help of the keyboard at each and every step and that becomes rather laborious and that in turn leads to errors and slow processing.

Research and development involve technical calculations to a high degree. In this field, meteorology seems to be an ideal outlet for information science, among other things, in view of the considerable number of variable factors we must take into account. This has led to the use of huge computers which we are not going to talk about here. But after the appearance of minicomputers, they have come into use in certain specific cases, such as the one involving the installation put up by the City of San Francisco, in the United States, to improve the sewage system. When rainfall exceeds the capacity of the water treatment stations, the sewers are flooded. To remedy this situation, rainfall detectors are scattered at about 30 points throughout the urban area. They have 120 detectors there, indicating the level of waste water in the various branches of the sewer system. These data enable a minicomputer to establish correlations between the rain showers and the overloading of the sewers and then immediately to decide if it is necessary to store the waste water in the basins or to move on to their treatment, depending upon the course taken by the thunderstorms. These studies made it possible to determine the work to be done and to prevent the flooding of sewers. It is rather interesting to note that certain sections in the city get much more rainfall than others, this is undoubtedly due to the particular configuration of the city which consists of several hills separated by deep ravines.

With this particular example--which rather clearly reveals the diversity of minicomputer application fields--we will conclude this article here.

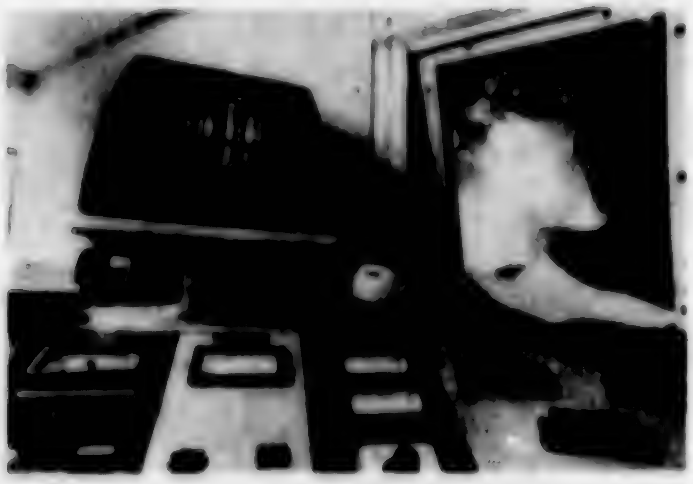

Figure 1. In the Hoogovens Steel Mills, in Holland, control systems, managed by minicomputers, make it possible with precision to follow the evolution of the various orders and to supervise the distribution of materials in the workshops. (Digital Equipment documents)

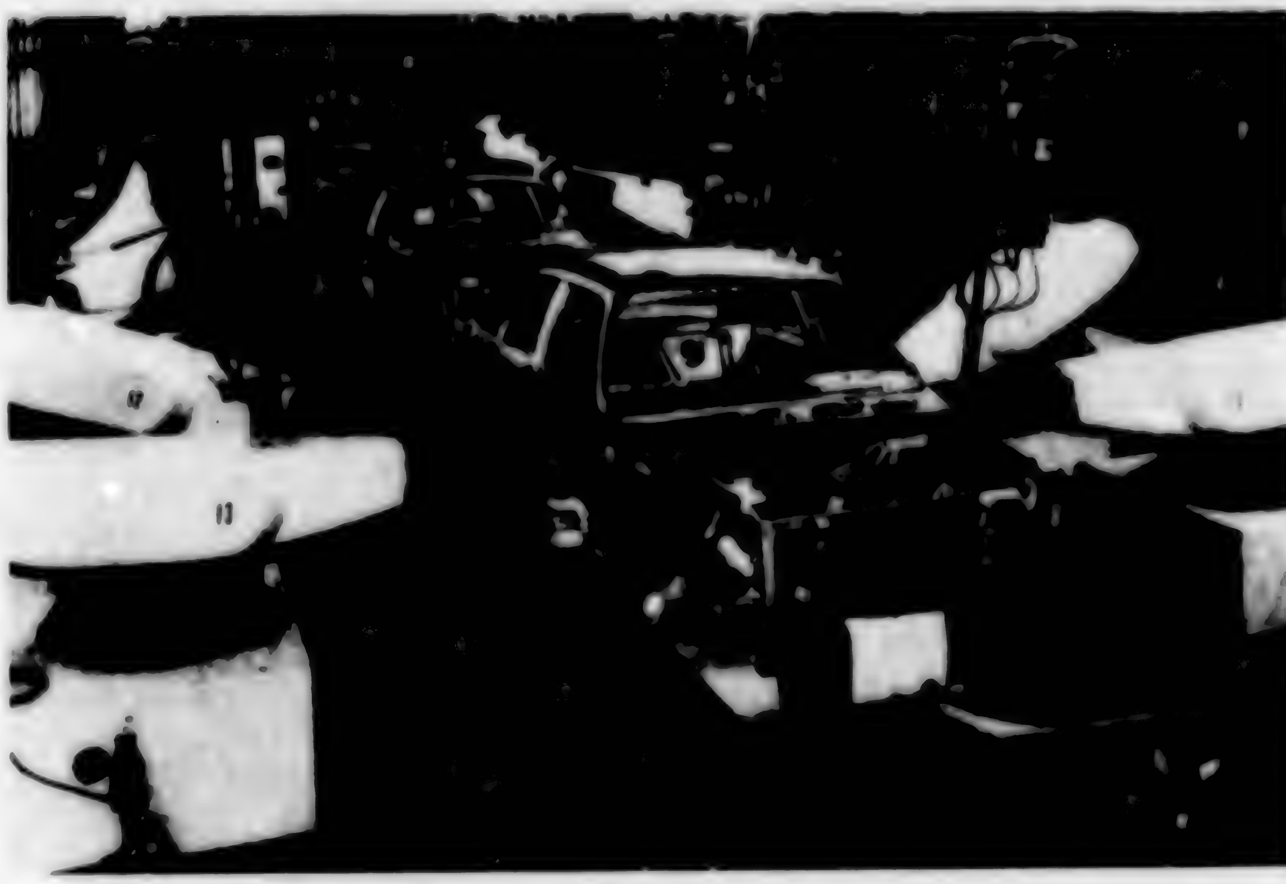

Figure 2. Automobile assembly line automated with the help of welding robots controlled by minicomputers (Computer Automation documents).

Figure 3. The photocomposition workshop of the Montligeon Printing Plant. The equipment comprises a Photon Pacesetter unit with a minicomputer which is connected to four continuous composition keyboards and two keyboards with screen for automatic correction of column widths.

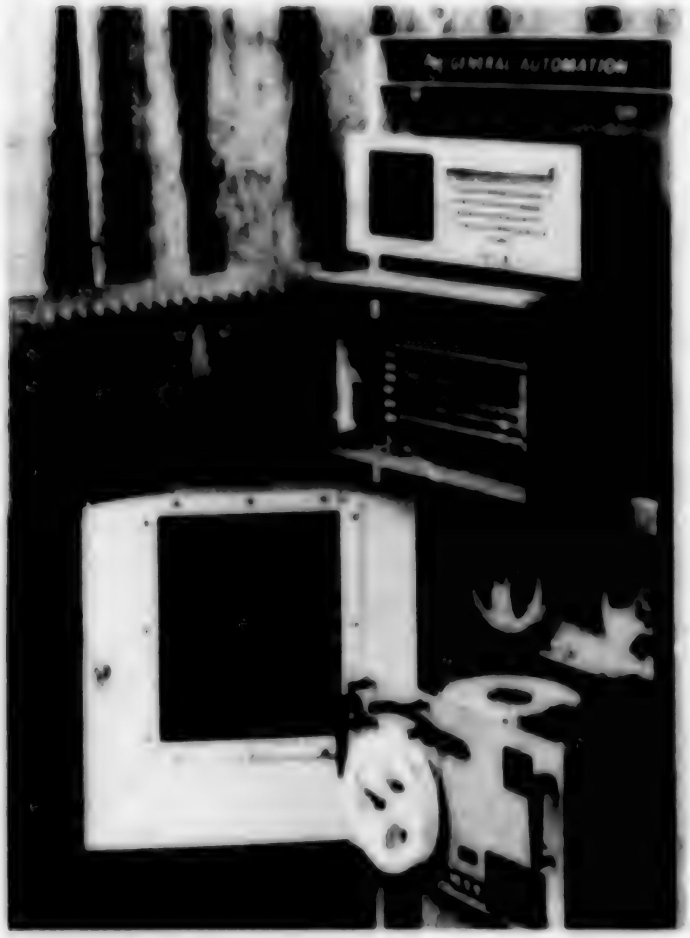

Figure 4. General Automation "Adapt-a-path" numerical control for machine-tools. From top to bottom: dialogue visualization console with alphanumerical keyboard and cathode screen; SPC 16 GA minicomputer comprising six calculation cards and six interface cards; punched tape reader and, below, punch.

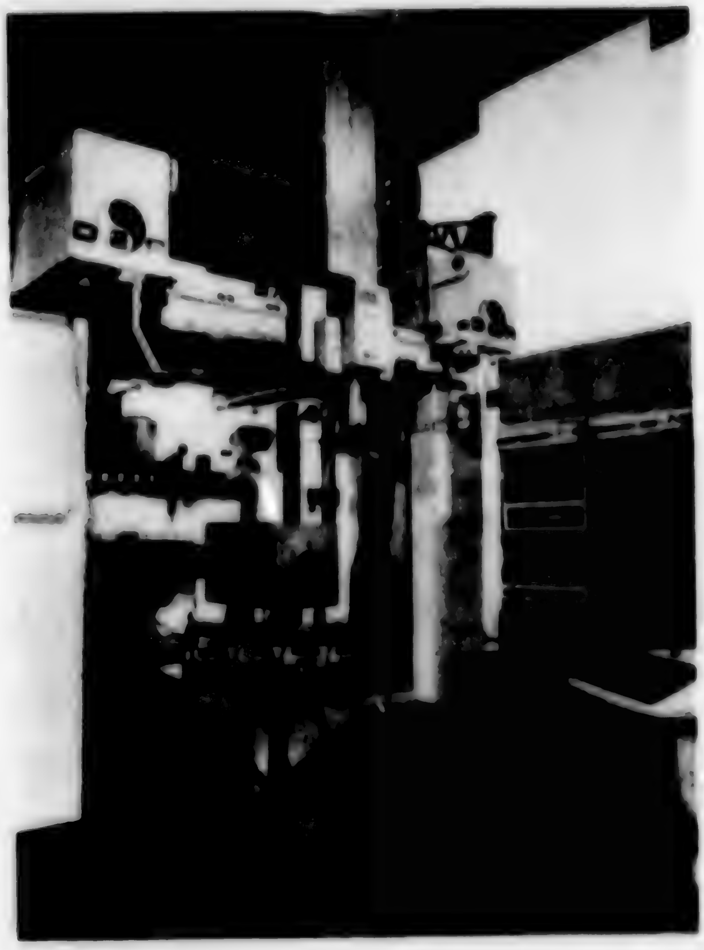

Figure 5. A very spectacular application of minicomputers in the field of mechanical production involves three-dimensional automatic machines for the control of pieces. Here is the most highly developed of these machines, presented by the Italian builder DEA at the EMO Exposition. This is a three-dimensional Sigma "automatic control center," directly run by a Digital Equipment minicomputer; it offers the possibility of changing not only the direction of the measurement testing probes but also the testing probes themselves as well as the tools in a conventional machining center.

Figure 6. Punched-tape unit using a programming console with PDP 8 E minicomputer; this tape is intended for the control of Behrens automatic turret punches, visible in the background (Digital Equipment document).

Figure 7. Numerical control with computer included, CN 741, shown at EMO by CIT-Alcatel. This cabinet, currently equipped with a Digital Equipment PDP 1105 SD minicomputer, is scheduled later on to receive a new LSI 11 central unit.

Figure 8. Laboratory information system, called DEC Lab 11/10, built around a PDP-11/10 minicomputer (Digital Equipment document).

Figure 9. The DEC lab graphic system comprises a DPD-11/40 minicomputer with 16-k memory (Digital Equipment document).

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REPORT OUTLINES RESEARCH ROLE, OBJECTIVES, FINANCING

Paris LE MONDE in French 22 Feb 80 p 12

[Text] With respect to the definition and financing of research policy, the General Delegation for Scientific and Technical Research (DGRST) should retain "an uncontested role of general programming, arbitration, appeals and the supervision of balances." This is one of the main conclusions of a report on the financing of research drafted by Robert Chabbal, former general director of the National Center for Scientific Research (CNRS), in close cooperation with the directors of research organizations and officials from the "research missions" of the principal ministries.

This 43-page report, which was submitted a few days ago to Pierre Aigrain, secretary of state to the prime minister in charge of research, should be one of the elements taken into consideration in the discussion now underway on the problem of "package research" and the role of the DGRST (LE MONDE, 17-18 February). In particular, Chabbal proposes new methods for the interministerial discussion of research budgets, methods aimed at facilitating dialog between the "actors" (research workers and organizations) and the "users" (the ministries and the private sector).

Three Circles

How is one to articulate the long-term objectives of the different ministries with the definition of a general research policy that would allow adequate room to maneuver for the scientific community? This is the question that Chabbal's report proposes to resolve. Initially designed to be but one element of the "10-year research plan" now being prepared under the aegis of the secretary of state for research, this searching piece of work, done at the request of the prime minister (particularly following the decisions made in November 1979 on oceanologic research), is now leading to concrete proposals that should soon be examined by the government.

By way of introduction, Chabbal notes that the "desire of economic and political officials to exercise more direct responsiblity in the orientation of scientific choices and therefore in decisions concerning the financing of programs" encounters, in the research apparatus, "a very general tendency toward openness, which makes new forms of dialog possible."

In order to make his proposals clearer, the former general director of the CNRS suggests a classification of research operations into three "circles."

The first circle includes "nonfinalized" research (whose sole purpose is the advancement of knowledge) and "exploratory" research, which "joins the objectives of knowledge and application," but on problems that are general and relatively long-term in nature.

The second circle is that of "finalized" research for which an objective in application is established and which may be "sponsored or ordered" by one or several "clients" (ministries, for example).

The third circle corresponds to the "major objectives" of technological development (launchers, satellites, airplane engines or, in a less "concrete" manner, economic automobiles, aquiculture farms, fuel production unit based on the biosphere). One characteristic of the projects of this third circle is that it must always be possible to establish specifications, to impose deadlines and above all, to show their economic feasibility.

The main proposals of the report concern the second circle, the one in which the dialog between research strictly speaking and the social and industrial environment takes place. Research of the first circle, which one can label "free research," must in fact remain essentially in the province of the research organizations, Chabbal believes, whether those organizations view it as their main vocation (as in the case of the CNRS) or whether it is only part of their task. In this connection, the report emphasizes that whatever the case, all research organizations, even those concentrating on a field of application (such as the National Institute of Agronomic Research -- INRA -- or the National Center for Development of the Oceans), should keep at least 20 percent of the "free research" in their activity. The role of the DGRST in this sector should only be to coordinate, unless a particular area seems "neglected" by the organizations.

New Budgetary Procedure

In Chabbal's opinion, research of the third circle -- one may speak of development here -- must be financed by the "client" ministries out of their intervention funds, eventually with participation of the productive sector (enterprises) or the financial sector (banks). The secretary of state for research would be informed of the projects of the different ministries, would give his scientific opinion and should rightfully participate in the interministerial committees in charge of making decisions about the most important projects.

For research of the second circle on the whole, which should lead to applications, Chabbal's report proposes a very far-reaching reform of the budgetary procedure. First of all, he believes that the drafting, by each ministry, of a medium- and long-term strategy should precede any choice of scientific programming. Certain ministries have recently endowed themselves

with planning structures that Chabbal believes should become the rule: "In this way, we would arrive at an announcement of strategy and objectives that would be a precious working tool for [research] [sic] organizations and laboratories, but whose benefits could be broader." For their part, research organizations should, in addition to traditional thematic programming, draw up short- and medium-term programming in the form of a "sliding 3-year masterplan."

According to the proposals of the work group, preparation of the research budget could take place in several phases: In the fall of every year, the ministries would file with the DGRST an overall program of action. In mid January, the research organizations would propose to the different ministries research programs taking objectives defined by the ministries into account. In mid March, the ministries, in possession of an estimate of their budgetary possibilities, would inform the DGRST of the list of projects they think should have priority from among the proposals of the organizations.

After arbitration by the DGRST or, if necessary, in an interministerial council meeting, the delegation could allocate to the budgetary lines of the different ministries the sums corresponding to the projects chosen and to be carried out by research organizations over which they have administrative tutelage.

According to the authors of the report, this method would present the advantage of permitting the organization of a multiform dialog between the organizations and the ministries and of breaking the current vertical "linearity" between the organizations and their sole tutelage ministry. In this way, every organization would continue to receive its means from a single ministry, but it would in fact owe its financing to all the ministries concerned by the programs it proposed to develop.

Clients and Tutelage

The distinction thus made between the "client" ministry and the ministry of tutelage should in principle be accompanied by a strengthening of the DGRST, confirmed in its role as a meeting place of means, initiatives and the desiderata of the different participants. In addition, Chabbal believes that the delegation should keep control over the Research Fund (some 450 million francs for 1980), "which constitutes the main element of flexibility in the proposed system." Nevertheless, this interministerial fund managed by the Office of Secretary of State for Research should "essentially, if not exclusively," have a role of promotion (to launch a program), appeal (to "save" a program which the "regular client" would refuse to finance, which makes it possible to avoid a "monopoly of financing"), liaison between industrial research and public research ("major function," the report emphasizes), and finally, a role of support for exploratory research in industrial laboratories.

In addition, the report emphasizes quite firmly certain problems now bothering research organizations, problems essentially concerning their "rigid" expenditures. It indicates, for example, that the rate of growth of the wage mass generally taken into account by budgets (1 percent in real terms) is often clearly lower than what is actually the case (1.8 percent in recent years for the CNRS and 2.75 percent for INRA, for example), which sometimes leads organization officials not to carry out all decisions made concerning the creation of posts included in the budget. Chabbal also says that pluri-annual programming of the "major apparatuses" (which generally exceed the needs and resources of a single organization) seems to be essential (the report notes in this connection that the biological disciplines in turn are going to need this type of what are generally collective facilities).

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FIAT'S VOLUMETRIC COMPRESSOR DISCUSSED

Palermo GIORNALE DI SICILIA in Italian 17 May 80 p 12

[Article by Giulio Mangano: "The Dance of the Figure Eights"]

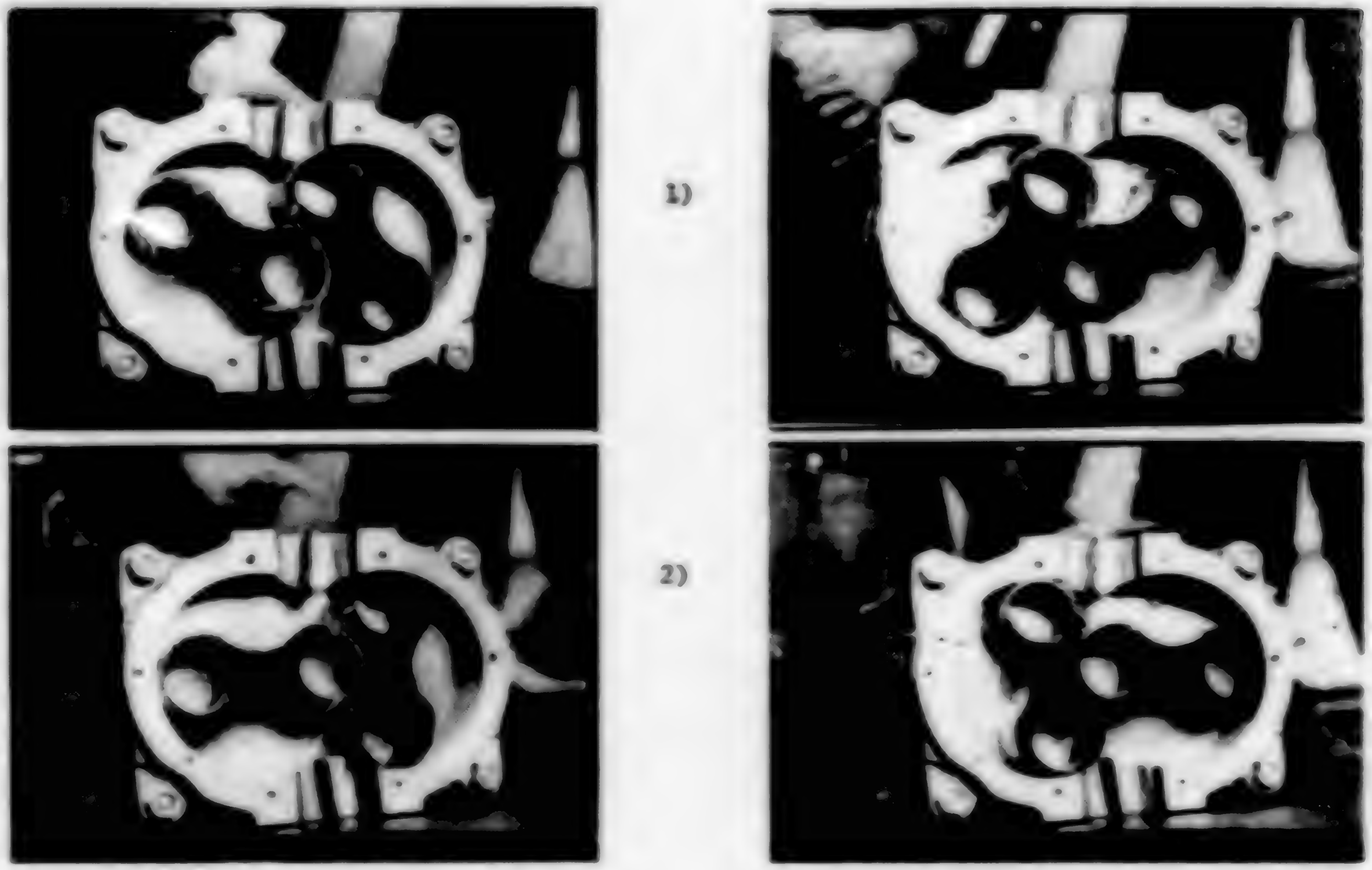
[Text] After 2 years of research, the Turin company already has today a clever device of its own creation for saving more than 10 percent of the fuel with equal performance characteristics.

Turin, May--"FIAT believes in supercharging." In these words spoken at the opening of the press conference held by engineer Aurelio Lampredi, one of the world's most prestigious engine designers (many of the engines of the Ferrari racing cars of the 1950's are his, and more recently, the "duty" engine of the 127/1,050 cc and that of the Ritmo Diesel) and president of Abarth, there is perhaps an important indication of what could become a notable technical orientation of the Turin company, and in the rather near future too.

When a few weeks ago, on the occasion of the Turin show, Umberto Agnelli estimated that by the end of the 1980's FIAT automobiles would be consuming more than 20 percent less fuel than the corresponding types do today, he indicated in a general way, as the route to be followed in order to achieve this ambitious result, the designing of increasingly sophisticated aerodynamic forms and the building of engines of higher efficiency.

Now FIAT, raising the curtain on a whole series of experimental research on supercharging carried out in the last 2 years, explains concretely what might be the route it intends to follow in order to optimize the output of its very next engines.

At present, supercharging (that is, putting the air-gasoline mixture into the cylinders at a pressure higher than atmospheric) can be done either with turbocompressors--that is, compressors that drive a turbine and that are "pushed" into rotation by the passage of the exhaust gases--or with volumetric compressors, connected mechanically to the engine shaft. FIAT has to be given credit for being the first, in this period of boom for the turbocompressors (Saab, Audi, BMW, Alfa Romeo, etc), to take the volumetric-compressor route, certainly a tougher one from the mechanical point of view, but better-suited to touring autos in many ways.



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In sequence, the functioning of the FIAT volumetric compressor. The two rotating elements of figure-8 section, rotate--the lefthand one counterclockwise and the right-hand one clockwise. The two vertical openings, above and below, are, respectively, the intake and output for the air-gasoline mixture that is pushed into the cylinders under pressure higher than atmospheric.

The 131 Abarth with modified aerodynamics (it can do 270 km per hour). Modified mechanically by the addition of the volumetric compressor, the 2-liter engine's power is raised to 290 HP. At the wheel is Alcide Paganelli, remembered as a champion of rallies in the mid-1970's and the organizer of a safari-rally.

Indeed, the turbocompressor begins to "push" only when the engine reaches high RPM, precisely because it operates on the exhaust gases, which become powerful only at the highest engine speeds. In brief, it is almost like a dog chasing its own tail. It works very well when maximum performance output is required from the car--one need only note how the "turbos" dominate the races: the Formula 1 Renault and the Lancia Beta Montecarlo (which also happens to belong to the FIAT group) in the Mondiale Marche--but works less well on everyday autos, for which best efficiency is required at low and medium engine speeds.

It is in this sector of use that the technical staff of engineer Lampredi--a man who has considerable experience of volumetric compressors used on racing cars in the immediate postwar period--has been able to demonstrate, tests in hand, that the "volumetric" can be a kind of panacea for the smaller cars too, and at the limit, for utility vehicles.

The experiments were carried out by applying the "made in FIAT" compressor first to the 2-liter engine of the 131 Racing and discovering that considerably more outstanding performance characteristics could be obtained (27 percent more maximum power and a full 39 percent more torque), with fuel consumption practically unchanged at constant speed.

The compressor was then applied to a smaller engine, the twin-shaft 1300 of the "131 Supermirafiori," and it was seen --again, with fuel consumption practically unchanged--that the performance achievable with a 2-liter induction-type engine was obtained.

In a word, the compressor has demonstrated that by improving the efficiency of the indiction-type engine it can either increase performance considerably while leaving fuel consumption unaltered, or make it possible to build cars of equivalent performance characteristics but with considerably lower fuel consumption (more than 10 percent less), because they would be powered by smaller engines.

The volumetric compressor could thus be FIAT's ace in the hole that enables it to offer, in the short term, cars with considerably reduced fuel consumption for equivalent performance characteristics, by comparison with current cars. Among other things, there are no contraindications to this approach, because FIAT is already in a position today, if it wants to, to produce its own volumetric compressor "in house"--thus, without being subject to any technical or commercial restrictions imposed by outside suppliers, as happens with other producers using turbocompressors.

The tests so far carried out have shown that the reliability of this solution is very high, while the levels of polluting gases emitted are reduced also.

A brief test with the 131 "Racing" and with the 1300 "Supermirafiori" equipped with the volumetric compressor has shown that practice confirms the theoretical assumptions. The 2-liter "Racing" really runs very smoothly and quietly and with truly exceptional acceleration and gear-flexibility characteristics, while the "little" 1300 has performance that is absolutely similar, if not indeed superior, to that of the 2-liter induction-type engines already referred to.

Finally, a "monster" was brought onto the FIAT "Mandria" course, the site of the exciting demonstration--a near-"dragster" built on the body of the 131 Abarth, incorporating on its 2-liter engine a volumetric compressor which, without too much effort, raises the power to 290 HP and the final speed to about 270 km per hour, with suitable ratios. Very exciting and unforgettable--the compressor is this too!

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TRANSPORTATION

FIRST RUN OF MAGNETIC TRAIN ON KASSEL TEST TRACK

Frankfurt/Main FRANKFURTER RUNDSCHAU in German 9 Jun 80 p 17

[Text] "Ladies and Gentlemen, Captain Hagenow and his crew welcome you on board the Transrapid 05. We have now started and will soon be leaving the railroad station." Just as on Friday on the test track of the Thyssen-Henschel plant in Kassel, this could also be heard in future in the railroad stations of the large European metropolises. By pressing symbolically on a button, Hessian Minister President Holger Boerner released for further testing the only operational publicly permitted magnetic train in the world.

A powerful humming of the magnets in the substructure of the streamlined white varnished carriage, which corresponds in its capacity to a railroad car, indicates that the car is ready to start. It starts moving almost unnoticeably, with many guests on board, but does not become louder. On the contrary. Without touching the tracks which guide it, the futuristic looking vehicle picks up speed softly, but powerfully. After a few moments the maximum speed of just 70 km per hour possible on the 600-meter-long test stretch was reached.

For Minister President Boerner, the new means of transportation, which was ready for use in less than a decade, is very satisfactory. "It is just like being in first class on the train or on a plane," he said after the first run of the nagmetic train in Hesse.

Without a single wheel turning, the magnetic train reaches its goal. Achievable speeds of 400 km per hour of the magnetic train will in the future fill the market gap between intercity trains and short-distance flights. The magic letters for this are EMS, which stand for Electro-Magnetic Suspension. The advantages of this type of travel are less noise pollution than in railroad and plane less energy consumption than short distance flights.

The principle of the magnetic train was already the subject of a patent application by Hermann Kemper in 1935. But only the modern regulation technology makes it possible to develop the magnetic train in its present form. The principle is that of the electric motor. But to be applied in the

Transrapid, it had to be "taken apart." The magnets are in the body of the car, the runners are located on the track. There is an air gap of 13 mm during the run between the track and the car. Magnets placed on t-e side of the car hold the Transrapid 05 on the track. Derailment or fall from the "tracks" carried by 5 meter-high posts is impossible.

The Transrapid has already undergone its crucial tests before the critical eyes of the world of specialists during the International Traffic Exhibition in Hamburg in 1979. The test unit came to Kassel, because the drive system developed by Thyssen-Henschel seems to be the most promising for the future. High-speed tests and continuous operation are to be carried out from 1980 on a 21-km-long test track in Emsland. At the same time tests will be made in Kassel to see how far permanent magnets can replace the electromagnets now being used.

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